

Application No. 10/529,117
Amendment dated January 22, 2007
Reply to Office Action of September 22, 2006

Docket No.: 4459-0461PUS1

REMARKS

Claims 1-4 and 6-20 are now present in this application.

The specification and claims 1-4 and 6-10 have been amended, claim 5 has been cancelled without prejudice or disclaimer, and claims 11-20 have been presented. Reconsideration of the application, as amended, is respectfully requested.

Amendments to Claims

Independent claim 1 has been amended to recite that a method of manufacturing an electronic device comprises the step of irradiating the hydrogen-containing layer with an energy beam to hydrogenate at least part of the semiconductor layer, wherein the hydrogen diffuses from the hydrogen-containing layer into the semiconductor layer; and forming the gate electrode over/under the semiconductor layer. Support for this amendment may be found throughout the specification as originally filed, including, for example, paragraphs [0033], [0041] and [0045] to [0051]. Accordingly, it is respectfully submitted that no new matter is present in the foregoing amendments.

Rejections under 35 USC 103

Claims 1, 4-6 and 8-10 stand rejected under 35 USC 103 as being unpatentable over Yamazaki et al., U.S. Patent 6,881,615, in view of Wolf et al., *Silicon Processing for the VLSI Era, Volume 1-Process Technology*, pp. 191-194. This rejection is respectfully traversed.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a

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prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

The Examiner asserts that Yamazaki et al. discloses a method of manufacturing a thin film transistor equivalent to that set forth in claim 1 of the present application, with the exception that, during the irradiation step, part of the semiconductor layer is hydrogenated. In order to address this deficiency, the Examiner asserts that Wolf et al. discloses a silicon nitride layer formed by PECVD which contains substantial amounts of atomic hydrogen (10-30%). According to the Examiner, during the irradiation step, hydrogen from the silicon nitride layer will diffuse into the underlying amorphous silicon layer, thereby hydrogenating the amorphous silicon layer.

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It is respectfully submitted that the Examiner's understanding of Yamazaki et al., Wolf et al., and the present invention are incorrect.

Independent claim 1 of the present application discloses a method of manufacturing an electronic device comprises the steps of: (a) forming the semiconductor layer over a substrate; (b) forming a hydrogen-containing layer over the semiconductor layer; (c) irradiating the hydrogen-containing layer with an energy beam to hydrogenate at least part of the semiconductor layer, wherein the hydrogen diffuses from the hydrogen-containing layer into the semiconductor layer; and then (d) forming the gate electrode over/under the semiconductor layer. Herein, the hydrogen-containing layer is irradiated and heated with the energy beam, causing the hydrogen to diffuse from the hydrogen-containing layer into the semiconductor layer.

The method of the present application shortens the hydrogenation period, thereby reducing the overall manufacturing time and cost. There is no intervening layer between the hydrogen-containing layer and the channel region to obstruct the diffusion path of the hydrogen during the hydrogenation period. Therefore, the diffusion length of the hydrogen is reduced, and fewer energy beam pulses are required in order to diffuse the hydrogen into the channel region. Also, by forming the overlying gate electrode or source and drain electrodes after the hydrogenation step, they are not subjected to the heat created by the incident energy beam. This enables the use of a higher intensity energy beam for the hydrogenation and thus further reduces the number of required pulses.

In Yamazaki et al., the Examiner asserts that column 12, lines 10-20 disclose the step of irradiating the silicon nitride layer with a laser. It is respectfully submitted that this is incorrect. With reference to column 12, lines 10-20 of Yamazaki et al., this patent only discloses that a

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laser beam at a wavelength of 248 nm was irradiated to the film (amorphous silicon film) to effect the laser annealing, so that the amorphous silicon was crystallized. Yamazaki et al. fails to teach or suggest that the silicon nitride layer is irradiated by a laser beam. Moreover, the object of the Yamazaki et al. reference is to provide a thin film semiconductor material having a high mobility and a process for forming the same with excellent reproducibility, to solve the problems with conventional laser annealing process. Thus, the objects of the Yamazaki et al. are not same as the objects of the present application.

Additionally, it is respectfully submitted that, even if Wolf et al. taught or suggested silicon nitride layer formed by PECVD contain substantial amounts of atomic hydrogen (10-30%), as asserted by the Examiner, it does not overcome the deficiencies of the primary reference to Yamazaki et al. Accordingly, neither Yamazaki et al. nor Wolf et al., either alone or in combination, teaches or suggests that the silicon nitride layer was irradiated by a laser beam.

In view of the foregoing amendments and remarks, it is respectfully submitted that the prior art utilized by the Examiner fails to teach or suggest the method of independent claim 1 and its dependent claims. Reconsideration and withdrawal of the 35 USC 103 rejection are respectfully requested.

Allowable Subject Matter

Applicant gratefully acknowledges that the Examiner considers claims 2, 3 and 7 to contain allowable subject matter. In view of the foregoing amendments and remarks, independent claim 1 and its dependent claims should all be in condition for allowance. It is also noted that newly presented independent claims 14 and 20 include limitations from claim 1, plus

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claims 2 and 7, respectively. Accordingly, these claims 14 and 20, as well as their dependent claims, should also be in condition for allowance.

Conclusion

Favorable reconsideration and an early Notice of Allowance are earnestly solicited.

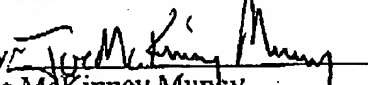
Because the additional prior art cited by the Examiner has been included merely to show the state of the prior art and has not been utilized to reject the claims, no further comments concerning these documents are considered necessary at this time.

In the event that any outstanding matters remain in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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